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Yoshiyuki Sasaki

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For: RECORDING OF INFORMATION ON RECORDING MEDIUM HAVING TEMPORARY SPARE AREA
Examiner: Lev Iwashko

SUBMISSION OF ENGLISH TRANSLATIONS OF JAPANESE PATENT APPLICATIONS

Commissioner for Patents
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Dear Sir:

Applicant herewith provides certified translations of the following priority documents.

Applicant herewith	Application No.	Date
Japan	2002-308308	October 23, 2001

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Respectfully submitted,

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I, Tadahiko Itoh, a Patent Attorney of Tokyo, Japan having my office at 32nd Floor, Yebisu Garden Place Tower, 20-3 Ebisu 4-Chome, Shibuya-Ku, Tokyo 150-6032, Japan do solemnly and sincerely declare that I am the translator of the attached English language translation and certify that the attached English language translation is a correct, true and faithful translation of Japanese Patent Application No. 2002-308308 to the best of my knowledge and belief.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

OCT. 23. 2006

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[Title of the Invention] Information Recording Apparatus, Information Recording Method, Program for Recording Information, Storage Medium for Storing the Program for Recording Information, and Information Recording System
[Scope of Claims]

[Claim 1] An information recording apparatus, comprising:

an information recording means for recording data on an information recording medium including a user data area for recording data requested by a user and a spare area for reallocating a defect exiting in the user data area;

a data reallocating means for reallocating the data to the spare area;

a temporary spare area recording means for generating a temporary spare area by temporarily copying the data in the spare area to the user data area; and a first updating means for updating the temporary spare area by copying the data in the spare area to another user data area when the data in the temporary spare area is changed.

[Claim 2] An information recording apparatus, comprising:

an information recording means for recording data on an information recording medium including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area;

a data reallocating means for reallocating the data to the spare area;

a temporary spare area recording means for generating a temporary spare area by temporarily copying the data in the spare area to the user data area; and

a second updating means for updating the temporary spare area by copying the data in the spare area to another user data area when the data in the spare area is changed.

[Claim 3] The information recording apparatus according to claim 1, wherein the first updating means updates the temporary spare area when the temporary spare area is overwritten by user data.

[Claim 4] The information recording apparatus according to claim 2, wherein the second updating means updates the temporary spare area when a recording area requested by the user is reallocated to the spare area and the data in the spare area is updated by recording performed in the spare area.

[Claim 5] The information recording apparatus according to claim 2, wherein the second updating means updates the temporary spare area when a defect area is newly detected in the user data area and the data in the spare area is reallocated in another spare area.

[Claim 6] The information recording apparatus according to claim 1, wherein

the information recording medium is an information recording medium according to a DVD + MRW standard;

the spare area is a Spare Area 2;

the temporary spare area is a Temporary Spare Area 2; and

the first updating means records a Temporary Secondary Table Area and Temporary Lead Out after recording another Temporary Spare Area 2 in an area followed by a Last Written Address when data of the Temporary Spare Area is changed.

[Claim 7] The information recording apparatus according to claim 2, wherein

the information recording medium is an information recording medium according to the DVD + MRW standard;

the spare area is a Spare Area 2,

the temporary spare area is a Temporary Spare Area 2; and

the second updating means records a Temporary Secondary Table Area and Temporary Lead Out after recording another Temporary Spare Area 2 in an area followed by a Last Written Address when data of the Spare Area 2 is changed.

[Claim 8] The information recording apparatus according to any one of claims 1 through 7, wherein the updating means ejection upon receiving a request for ejecting the information recording medium from the user.

[Claim 9] The information recording apparatus according to any one of claims 1 through 7, wherein the updating means performs formatting suspension upon receiving a request for formatting suspension from the user.

[Claim 10] An information recording apparatus, comprising:

an information recording means for recording data on an information recording medium including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area;

a background formatting means for formatting the information recording medium in a background;

a background formatting resuming means for resuming background formatting when the information recording medium is partially formatted;

a data reallocating means for reallocating the data to the spare area;

a temporary spare area recording means for generating a temporary spare area by temporarily copying the data in the spare area to the user data area; and

a first resuming means for resuming the background formatting when the data in the temporary spare area is changed.

[Claim 11] An information recording apparatus, comprising

an information recording means for recording data on an information recording medium including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area;

a background formatting means for formatting the information recording medium in a background;

a background formatting resuming means for resuming background formatting when the information recording medium is partially formatted;

a data reallocating means for reallocating the data to the spare area;

a temporary spare area recording means for generating a temporary spare area by temporarily copying the data in the spare area to the user data area; and

a second resuming means for resuming the background formatting when the data in the spare area is changed.

[Claim 12] The information recording apparatus according to claim 10, wherein the first resuming means resumes the background formatting when the temporary spare area is overwritten by user data.

[Claim 13] The information recording apparatus according to claim 11, wherein the second resuming means resumes the background formatting when a recording area requested by the user is reallocated to the spare area and the data in the spare area is updated by recording performed in the spare area.

[Claim 14] The information recording apparatus according to claim 11, wherein the second resuming means resumes the background formatting when a defect area is newly detected in the user data area and the data in the spare area is reallocated to another spare area.

[Claim 15] The information recording apparatus according to claim 10, wherein

the information recording medium is an information recording medium according to the DVD + MRW standard;

the spare area is a Spare Area 2;

the temporary spare area is a Temporary Spare Area 2; and

the first resuming means resumes the background formatting when the data in the Temporary Spare Area 2 is changed.

[Claim 16] The information recording apparatus according to claim 11, wherein

the information recording medium is an information recording medium according to the DVD + MRW standard;

the spare area is a Spare Area 2;

the temporary spare area is a Temporary Spare Area 2; and

the second resuming means resumes the background formatting when the data in the Spare Area 2 is changed.

[Claim 17] An information recording method, using hardware resources, for executing:

an information recording step of recording data on an information recording medium including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area;

a data reallocating step of reallocating the data to the spare area;

a temporary spare area recording step of generating a temporary spare area by temporarily copying the data in the spare area to the user data area; and

a fist updating step of updating the temporary spare area by copying the data in the spare area to another user data area when the data in the temporary spare area is changed.

[Claim 18] An information recording method, using hardware resources, for executing:

an information recording step of recording data on an information recording medium including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area;

a data reallocating step of reallocating the data to the spare area;

a temporary spare area recording step of generating a temporary spare area by temporarily copying the data in the spare area to the user data area; and

a second updating step of updating the temporary spare area by copying the data in the spare area to another user data area when the data in the spare area is changed.

[Claim 19] An information recording method, using hardware resources, for executing:

an information recording step of recording data on an information recording medium including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area;

a background formatting step of formatting the information recording medium in a background;

a background formatting resuming step of resuming background formatting when the information recording medium is partially formatted;

a data reallocating step of reallocating the data to the spare area;

a temporary spare area recording step of generating a temporary spare area by temporarily copying the data in the spare area to the user data area; and

a first resuming step of resuming the background formatting when the data in the temporary spare area is changed.

[Claim 20] An information recording method, using hardware resources, for executing:

an information recording step of recording data on an information recording medium including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area;

a background formatting step of formatting the information recording medium in a background;

a background formatting resuming step of resuming background formatting when the information recording medium is partially formatted;

a data reallocating step of reallocating the data to the spare area;

a temporary spare area recording step of generating a temporary spare area by temporarily copying the data in the spare area to the user data area; and

a second resuming step of resuming the background formatting when the data in the spare area is changed.

[Claim 21] A machine-readable program for recording information, installed in a computer, for causing the computer to execute:

an information recording step of recording data on an information recording medium including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area;

a data reallocating step of reallocating the data to the spare area;

a temporary spare area recording step of generating a temporary spare area by temporarily copying the data in the spare area to the user data area; and

a first updating step of updating the temporary spare area by copying the data in the spare area to another user data area when the data in the temporary spare area is changed.

[Claim 22] A machine-readable program for recording information installed in a computer, for causing the computer to execute:

an information recording step of recording data on an information recording medium including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area;

a data reallocating step of reallocating the data to the spare area;

a temporary spare area recording step of generating a temporary spare area by temporarily copying the data in the spare area to the user data area; and

a second updating step of updating the temporary spare area by copying the data in the spare area to another user data area when the data in the spare area is changed.

[Claim 23] A machine-readable program for recording information installed in a computer, for causing the computer to execute:

an information recording step of recording data on an information recording medium including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area;

a background formatting step of formatting of information recording medium in a background;

a background formatting resuming step of resuming background formatting when the information recording medium is partially formatted;

a data reallocating step of reallocating the data to the spare area;

a temporary spare area recording step of generating a temporary spare area by temporarily copying the data in the spare area to the user data area; and

a first resuming step of resuming the background formatting when the data in the temporary spare area is changed.

[Claim 24] A machine-readable program for recording information installed in a computer, for causing the computer to execute:

an information recording step of recording data on an information recording medium including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area;

a background formatting step of formatting the information recording medium in a background;

a background formatting resuming step of resuming background formatting when the information recording medium is partially formatted;

a data reallocating step of reallocating the data to the spare area;

a temporary spare area recording step of generating a temporary spare area by temporarily copying the data in the spare area to the user data area; and

a second resuming step of resuming the background formatting when the data in the spare area is changed.

[Claim 25] A storage medium for storing the program for recording information according to claims 21 through 24.

[Claim 26] An information recording system, comprising:

an information recording apparatus for recording data on an information recording medium and including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area; and

a host apparatus which instructs the information recording apparatus to perform an information recording operation; wherein

either one of or both of the information recording apparatus and the host apparatus include as a whole:

an information recording means for recording data on the information recording medium;

a data reallocating means for reallocating the data to the spare area;

a temporary spare area recording means for generating a temporary spare area by temporarily copying the data in the spare area to the user data area; and

a first updating means for updating the temporary spare area by copying the data in the spare area to another user data area when the data in the temporary spare area is changed.

[Claim 27] An information recording system, comprising:

an information recording apparatus for recording data on an information recording medium and including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area; and

a host apparatus for instructing the information recording apparatus to perform an information recording operation, wherein any one of or both of the information recording apparatus and the host apparatus include as a whole:

an information recording means for recording data on the information recording medium;

a data reallocating means for reallocating the data to the spare area;

a temporary spare area recording means for generating a temporary spare area by temporarily copying the data in the spare area to the user area; and

a second updating means for updating the temporary spare area by copying the data in the spare area to another user data area when the data in the spare area is changed.

[Claim 28] An information recording system, comprising:

an information recording apparatus for recording data on an information recording medium and including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area; and

a host apparatus for instructing the information recording apparatus to perform an information recording operation, wherein any one of or both of the information recording apparatus and the host apparatus include as a whole:

an information recording means for recording data on the information recording medium;

a background formatting means for formatting the information recording medium in a background;

a background formatting resuming means for resuming background formatting when the information recording medium is partially formatted;

a data reallocating means for reallocating the data to the spare area;

a temporary spare area recording means for generating a temporary spare area by temporarily copying the data in the spare area to the user data area; and

a first resuming means for resuming the background formatting when the data in the temporary spare area is changed.

[Claim 29] An information recording system, comprising:

an information recording apparatus for recording data on an information recording medium and including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area, and a host apparatus for instructing the information recording apparatus to perform an information recording operation, wherein

any one of or both of the information recording apparatus and the host apparatus include as a whole:

an information recording means for recording data on the information recording medium;

a background formatting means for formatting the information recording medium in a background;

a background formatting resuming means for resuming background formatting when the information recording medium is partially formatted;

a data reallocating means for reallocating the data to the spare area;

a temporary spare area recording means for generating a temporary spare area by copying the data in the spare area to the user data area; and

a second resuming means for resuming the background formatting when the data in the spare area is changed.

[Detailed Description of the Invention]

[0001]

[Technical Field of the Invention]

The present invention relates to an information recording apparatus for recording information in an information recording medium having a user data area and a spare area, an information recording method, a program for recording information, a storage medium for storing the program for recording information, and an information recording system.

[0002]

[Background Art]

A Mt. Rainier standard is proposed as a format which adds a defect management function to a rewritable CD disk or a DVD disk. The Mr. Rainier standard offers a format on which the defect management function is newly added on a rewritable CD - RW disk or a DVD + RW disk while maintaining compatibility with a conventional recording format.

[0003]

Characteristics of the Mr. Rainier standard are described as follows.

(1) First characteristic

The first characteristic of the Mt. Rainier standard is that a defect management area and a spare area are arranged in a user data area of a conventional format.

[0004]

Specifically, the defect management area exists in an area called a Main Table Area (hereinafter abbreviated to as MTA) in a lead-in area and in an area called a Secondary Table Area (hereinafter abbreviated to as STA) in the user data area of the conventional format.

[0005]

In addition, the spare area is recorded in a spare area (hereinafter abbreviated as SA) in the user data area of the conventional format.

[0006]

Accordingly, even when a disk recorded according to the Mr. Rainier format is inserted into a drive device (hereinafter referred to as a conventional drive device) which does not support the Mr. Rainier standard, a spare sector may be properly read by using a specific driver (hereinafter referred to as an MRW driver). This is because the defect management area and the spare area exist in the user data area which may be accessed by a conventional drive device.

[0007]

For instance, when a DVD + MRW disk, which is a DVD + RW disk recorded by the Mr. Rainier format, is inserted into the conventional drive device, the conventional drive device recognizes that the DVD + RW disk is inserted and reports necessary information to a user. This is because the DVD + MRW is compatible with the conventional DVD + RW standard. In response to a report that the DVD + RW disk is inserted, the MRW driver may recognize that the DVD + MRW disk is inserted by reading a predetermined address on the disk. This is because that the Mr. Rainier standard is designed to record information indicative of the Mr. Rainier disk at a predetermined address in the user data area. When the MRW driver accordingly recognizes that the DVD + MRW disk is inserted, the MRW driver reads out the defect management area recorded in a predetermined area in the user data area and obtains information about the spare sector. The spare area itself exists in the user data area. In response to a data read request from the user, the

MRW driver obtains a relevant spare area based on defect management information when the data read request includes a defective area, and requests the conventional drive device to read the relevant spare area. Thus even the conventional drive device may properly read the DVD + MRW disk including the spare sector. On the other hand, if a drive device supports the DVD + MRW (such a device is hereinafter referred to as an MRW drive device), the spare sector may be properly read without use of the MRW driver.

[0008]

A difference between the CD - MRW and the DVD + MRW, both which are the Mr. Rainier standard for the CD - RW, is in an arrangement of SA. Both the CD - MRW and the DVD + MRW have spare areas in the user data area. While the SA of the CD - MRW are distributed in the user data area, the SA of the DVD + MRW is arranged in two areas, that is, an innermost circumference and an outermost circumference of the user data area. The SAs in the innermost and the outermost circumferences of the user data area are referred to as SA1 and SA2, respectively.

(2) Second characteristic

Another characteristic of the Mt. Rainier standard is background formatting. In the background formatting, a user making a formatting request is notified of a formatting completion message after only a portion of a lead-in area is recorded. Dummy data is recorded on remaining portions of the lead-in area when there is no access from the user. After receiving the formatting completion message, the user may randomly record or reproduce data on all the user data area on the disk.

[0009]

In addition, a disk may be removed from the drive device during the background formatting before completing recording on entire surface of the disk. When removing the disk during the background formatting, the dummy data is recorded on an unrecorded area existing between recorded data so as to cause the conventional drive device to properly read the partially-formatted disk. Then in order for the MRW driver to obtain the defect management information, a temporary STA (hereinafter referred to as TSTA) is recorded from a Last Written Address (hereinafter referred to as LWA) recorded with user data or by formatting. Finally, the disk is ejected after recording Temporary Lead Out (hereinafter referred to TLO). In a case of the DVD + MRW disk, when a defect is detected during formatting and a disk reallocated to the SA2 is removed, a Temporary Spare Area 2 (hereinafter referred to as TSA2) is obtained from the LWA, and data reallocated to the SA2 is then copied, followed by recording of the TSTA and the TLO. That is, since the SA2 in the DVD + MRW is located at the outermost circumference of the user data area, processing of recording the dummy data to the unrecorded areas up to the SA2 is omitted to shorten required time for removing the disk. The TSA2 is a temporary spare area for use by the conventional drive device to read the spared data. A size of the TSA2 is a sum of all areas actually used for a purpose of sparing in the SA2.

(3) Illustrative example

Fig. 7 is a drawing illustrating a recording format of the CD - MRW and the DVD + MRW. Fig. 7(a) and Fig. 7(b) illustrate the recording format of the CD - MRW and the DVD + MRW, respectively.

[0010]

Both the CD - MRW and the DVD + MRW are divided into a Lead in Zone, a Data Zone, and a Lead Out Zone.

[0011]

An MTA (Main Table Area) exists in the Lead in Zone.

[0012]

A GAA (General Application Area), an SA (Spare Area), a DA (Data Area), and an STA (Secondary Table Area) exist in the Data Zone. In a Mr. Rainier format, defect management information and information about formatting status are recorded in the MTA and the STA. The STA is a copy of what is in the MTA and is located in the Data Zone. User data is recorded in the DA. When a defect is detected in the DA during data recording, the SA is reallocated. In addition, information necessary for the MRW driver to identify an MRW disk when the MRW disk is inserted in a conventional drive device, and so forth, are recorded in the GAA.

[0013]

As described above, in the MRW, the STA which is the defect management area and the SA which is the spare area are arranged in the Data Zone which is accessible by the conventional drive device. Accordingly, the conventional drive device may read including the spare area.

[0014]

In addition, a difference between the CD - MRW and the DVD + MRW is in an arrangement of the SA. As illustrated in Fig. 7(a), the SA and the DA are dispersedly arranged. On the other hand as illustrated in Fig.(b), in the DVD + MRW, the SA1 and the SA2 are arranged in the innermost circumference and the outermost circumference of the Data Zone, respectively. Accordingly, the DA for recording the user data contiguously exists.

[0015]

Fig. 8 is a drawing illustrating recording status of a partially formatted CD - MRW and a DVD + MRW. Fig. 8(a) and Fig. 8(b) illustrate the recording format of the CD - MRW and the recording format of the DVD + MRW, respectively.

[0016]

In the CD - MRW, a TSTA (Temporary Secondary Table Area) is recorded followed by an area in which recording is carried out by a user or an area on which dummy data is recorded by formatting, and a TLO (Temporary Lead Out) is added. MTA information is copied to the TSTA, and the defect management information and the information about the formatting status are recorded in the TSTA. The MRW driver refers to the TSTA to obtain spare information. Since the SA dispersedly exists in the CD - MRW, a defect found in an i^th DA is generally replaced by an i^th SA.

[0017]

On the other hand, in a case of the DVD + MRW, since the spare areas exist only in the SA1 and the SA2, the SA2 may be used during background formatting. When the SA2 is used, it is necessary to record dummy data in an area from a formatted area to the SA2 to cause the conventional drive device to read the data reallocated to the SA2. However, since the SA2 exists at the very end of the user data area, a disk to be allocated to the SA2 may not be practically removed until formatting is completed. To avoid such a problem, in the DVD + MRW as illustrated in Fig. 8(b), data reallocated to the SA2 is copied to the TSA2 (Temporary SA2) located after the formatted area. The disk is then ejected after recording the TSTA and the TLO followed by the TSA2.

[0018]

In addition, "De-iced" in Fig. 8 indicates an area on which data is recorded. That is, "iced" means an unrecorded area and "De-iced" means elimination of the unrecorded area.

(4) Art disclosed in publication

A patent document 1 proposes an information recording apparatus for recording spared data in the user data area. In the information recording apparatus, a part of the user data area is reallocated as a spare area when there is a possibility of occurrence of a large number of defect areas depending on a condition of the disk. The user data area allocated as the spare area is then used as the spare area.

[0019]

[Patent document 1]

Japanese Patent Application Laid-Open No. Hei10-021552

[0020]

[Problems to be Solved]

However, in a case of adopting the Mr. Rainier standard, if data is added on a partially formatted DVD + MRW disk, a problem as follow occurs. The problem is described with reference to Fig. 9.

[0021]

Fig. 9 is an example of a frame format illustrating a case when TAS2 is required to be updated. Fig. 9(a) illustrates a partially formatted DVD + MRW. In Fig. 9(a), data reallocated to the SA2 is copied to the TSA2 followed by a formatted area. The TSTA and the TLO are recorded thereafter.

(1) First problem

As illustrated in Fig. 9(b), since the TSA2 exists in the user data area, the TSA2 may be overwritten by the user data.

[0022]

At the same time, when the TSTA and the TLO which similarly exist in the user data area are overwritten by the user data, the drive device is designed to resume the background formatting. When formatting is resumed, the TSA2, TSTA, and the TLO are again recorded from a new LWA at a time of disk discharge. Thus the areas as described above may be prevented from being destroyed by being overwritten by the user data.

[0023]

However, no consideration is given to a case when the TSA2 is overwritten with the user data. Therefore, even when the TSA2 is overwritten with the user data, the TSA2 is not rerecorded by a background formatting resuming means, and so forth. For this reason, in a case of the TSA2 is over written by the user data as illustrated in Fig. 9(b), the TSA2 may remain being overwritten. When a disk on which such TSA2 is overwritten with the user data is inserted intro a conventional drive device, a problem such that the conventional drive device gives incorrect spare data to a user occurs. That is, when the TSA2 is overwritten by the user data in processing of adding the user data on a partially formatted disk, there is a case in which the TSA2 does not correctly reflect information of the SA2. Accordingly, when such a disk is inserted into the conventional drive device, incorrect information may be given to the user.

(2) Second problem

There may be a case in which a user may perform data recording in an area replaced by the SA2. In this case as illustrated in Fig. 9(c), data in the SA2 is updated.

[0024]

It is to be noted that the TSA2 is for the conventional drive device to read the spared data. The MRW drive device refers to an original SA2 to record data required by a user in the SA2. Accordingly, there is difference between data recorded in the SA2 and the TSA2.

[0025]

When the SA2 is updated in processing of adding the user data on such a partially formatted disk, there is a case in which the TSA2 does not correctly reflect information of the SA2. Accordingly, when such a disk is inserted into the conventional drive device, incorrect information may be given to the user.

(3) Third problem

A problem also arise when a new defect area is detected during recording of the user data.

[0026]

As described above, a size of the TSA2 is only as big as a sum of all areas used for replacement in the SA2. Thus as illustrated in Fig. 9(d), there is problem such that there is no area left for recording newly detected spare information.

[0027]

It is an object of the present invention to cause a temporary spare area (TSA2, for instance) to correctly reflect data of a spare area (SA2, for instance) even when a user records data in the temporary spare area (TSA2, for instance) of a partially formatted DVD + MRW disk or a similar recording medium.

[0028]

It is an object of the present invention to cause a temporary spare area (TSA2, for instance) to correctly reflect data of a spare area (SA2, for instance) even when the temporary spare area (TSA2, for instance) or the spare area (SA2, for instance) of a partially formatted DVD + MRW disk or a similar recording medium is overwritten.

[0029]

[Means for Solving the Problems]

The invention according to claim 1 refers to an information recording apparatus, including an information recording means for recording data on an information recording medium including a user data area for recording data requested by a user and a spare area for reallocating a defect exiting in the user data area, a data reallocating means for reallocating the data to the spare area, a temporary spare area recording means for generating a temporary spare area by temporarily copying the data in the spare area to the user data area, and a first updating means for updating the temporary spare area by copying the data in the spare area to another user data area when the data in the temporary spare area is changed.

[0030]

Accordingly, when the data in the temporary spare area is changed, data in the spare area is copied to another user data area. Thus the temporary spare area may be updated and correct spare data may be always recorded in the temporary spare area.

[0031]

The invention according to claim 2 refers to an information recording apparatus, including an information recording means for recording data on an information recording medium including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area, a data reallocating means for reallocating the data to the spare area, a temporary spare area recording means for generating a temporary spare area by temporarily copying the data in the spare area to the user data area, and a second updating means for updating the temporary spare area by copying the data in the spare area to another user data area when the data in the spare area is changed.

[0032]

Accordingly, when the spare area is updated, data in the spare area is copied to another user data area. Thus, the temporary spare area may be updated and correct spare data may be always recorded in the temporary spare area.

[0033]

The invention according to claim 3 refers to the information recording apparatus according to claim 1, wherein the first updating means updates the temporary spare area when the temporary spare area is overwritten by user data.

[0034]

Accordingly, when the temporary spare area is overwritten by the user data, data in the spare area is copied to another user data area. Thus, the temporary spare area may be updated and correct spare data may be always recorded in the temporary spare area.

[0035]

The invention according to claim 4 refers to the information recording apparatus according to claim 2, wherein the second updating means updates the temporary spare area when a recording area requested by the user is reallocated to the spare area and the data in the spare area is updated by recording performed in the spare area.

[0036]

Accordingly, when the spare area is updated by recording performed in the spare area, data in the spare area is copied to another user data area. Thus, the temporary spare area may be updated and correct spare data may be always recorded in the temporary spare area.

[0037]

The invention according to claim 5 refers to the information recording apparatus according to claim 2, wherein the second updating means updates the temporary spare area when a defect area is newly detected in the user data area and the data in the spare area is reallocated in another spare area.

[0038]

Accordingly, when a defect area is newly detected in the user data area and the data in the spare area is reallocated in another spare area, data in the spare area is copied to another user data area. Thus, the temporary spare area may be updated and correct spare data may be always recorded in the temporary spare area.

[0039]

The invention according to claim 6 refers to the information recording apparatus according to claim 1, wherein the information recording medium is an information recording medium according to a DVD + MRW standard, the spare area is a Spare Area 2, the temporary spare area is a Temporary Spare Area 2, and the first updating means records a Temporary Secondary Table Area and Temporary Lead Out after recording another Temporary Spare Area 2 in an area followed by a Last Written Address when data of the Temporary Spare Area is changed.

[0040]

Accordingly, effect according to the invention described in claim 1 may be achieved in the information recording medium according to the DVD + MRW standard.

[0041]

The invention according to claim 7 refers to the information recording apparatus according to claim 2, wherein the information recording medium is an information recording medium according to the DVD + MRW standard, the spare area is a Spare Area 2, the temporary spare area is a Temporary Spare Area 2, and the second updating means records a Temporary Secondary Table Area and Temporary Lead Out after recording another Temporary Spare Area 2 in an area followed by a Last Written Address when data of the Spare Area 2 is changed.

[0042]

Accordingly, effect according to the invention described in claim 1 may be achieved in the information recording medium according to the DVD + MRW standard.

[0043]

The invention according to claim 8 refers to the information recording apparatus according to any one of claims 1 through 7, wherein the updating means performs ejection upon receiving a request for ejecting the information recording medium from the user.

[0044]

Since the temporary spare area is updated only at a time when the information recording medium is being ejected, updating processing of the temporary spare area may be prevented from lowering performance of a user request for data recording. In addition, since the data of the temporary spare area is properly recorded in the ejected information recording medium, the spare data is read by the conventional drive device without fail.

[0045]

The invention according to claim 9 refers to the information recording apparatus according to any one of claims 1 through 7, wherein the updating means performs formatting suspension upon receiving a request for formatting suspension from the user.

[0046]

Since the temporary spare area is updated only at a time of receiving the request for formatting suspension from the user, updating processing of the temporary spare area may be prevented from lowering performance of a user request for data recording. In addition, since the data of the temporary spare area is properly recorded in the ejected information recording medium, the spare data is read by the conventional drive device without fail.

[0047]

The invention according to claim 10 refers to an information recording apparatus, including an information recording means for recording data on an information recording medium including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area, a background formatting means for formatting the information recording medium in a background, a background formatting resuming means for resuming background formatting when the information recording medium is partially formatted, a data reallocating means for reallocating the data to the spare area, a temporary spare area recording means for generating a temporary spare area by temporarily copying the data in the spare area to the user data area, and a first resuming means for resuming the background formatting when the data in the temporary spare area is changed.

[0048]

An electrical source of the information recording apparatus (drive device) may be cut off without the information recording medium (optical disk) being ejected after the temporary spare area (TSA2) is overwritten by user data or after the spare area (SA2) is updated. In this case, the temporary spare area (TSA2) may not be updated and a problem such that the incorrect spare data is left recorded may occur. Such a problem may be prevented from occurring by resuming the background formatting when it is necessary to update the temporary spare area (TSA2). When the information recording medium (optical disk) halfway through the formatting is inserted in a DVD + MRW, a host apparatus monitoring formatting status is designed to suspend the background formatting when a user request for disk ejection or a request for cutting off the electrical source for a computer is made during the background formatting. In other words, when the background formatting is resumed at a time of the user records the data in the temporary spare area (TSA2), for instance, the host apparatus is to monitor the user request for disk ejection or the request for cutting off the electrical source for the computer, and is to issue a request for formatting suspension to the information recording apparatus (drive device) upon request.

Accordingly, the information recording apparatus (drive device) may perform the updating processing of the temporary spare area (TSA2) at a time of receiving a request for background formatting suspension. In addition, when the request for formatting suspension is not made, data is recorded up to a position of an original spare area (SA2), preventing incorrect spare data from being recorded. Thus, the information recording medium (optical disk) with the incorrect spare data may be prevented from being ejected. As described above, the background formatting is resumed when it is necessary to update the temporary spare area. Thus the incorrect spare data may be prevented from being recorded in the temporary spare area of the information recording medium due to cutoff of the electrical source of the drive device before the temporary spare area is updated.

[0049]

The invention according to claim 11 refers to an information recording apparatus, including an information recording means for recording data on an information recording medium including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area, a background formatting means for formatting the information recording medium in a background, a background formatting resuming means for resuming background formatting when the information recording medium is partially formatted, a data reallocating means for reallocating the data to the spare area, a temporary spare area recording means for generating a temporary spare area by temporarily copying the data in the spare area to the user data area, and a second resuming means for resuming the background formatting when the data in the spare area is changed.

[0050]

An electrical source of the information recording apparatus (drive device) may be cut off without the information recording medium (optical disk) being ejected after the temporary spare area

(TSA2) is overwritten by user data or after the spare area (SA2) is updated. In this case, the temporary spare area (TSA2) may not be updated and a problem such that the incorrect spare data is left recorded may occur. Such a problem may be prevented from occurring by resuming the background formatting when it is necessary to update the temporary spare area (TSA2). When the information recording medium (optical disk) halfway through the formatting is inserted in a DVD + MRW, a host apparatus monitoring formatting status is designed to suspend the background formatting when a user request for disk ejection or a request for cutting off the electrical source for a computer is made during the background formatting. In other words, when the background formatting is resumed at a time of the user records the data in the temporary spare area (TSA2), for instance, the host apparatus is to monitor the user request for disk ejection or the request for cutting off the electrical source for the computer, and is to issue a request for formatting suspension to the information recording apparatus (drive device) upon request. Accordingly, the information recording apparatus (drive device) may perform the updating processing of the temporary spare area (TSA2) at a time of receiving a request for background formatting suspension. In addition, when the request for formatting suspension is not made, data is recorded up to a position of an original spare area (SA2), preventing incorrect spare data from being recorded. Thus, the information recording medium (optical disk) with the incorrect spare data may be prevented from being ejected. As described above, the background formatting is resumed when it is necessary to update the spare area. Thus the incorrect spare data may be prevented from being recorded in the temporary spare area of the information recording medium due to cutoff of the electrical source of the drive device before the temporary spare area is updated.

[0051]

The invention according to claim 12 refers to the information recording apparatus according to claim 10, wherein the first resuming means resumes the background formatting when the temporary spare area is overwritten by user data.

[0052]

Accordingly, when the temporary spare area is overwritten by the user data, the background formatting is resumed. Thus the incorrect spare data may be prevented from being recorded in the temporary spare area of the information recording medium due to cutoff of the electrical source of the drive device before the temporary spare area is updated.

[0053]

The invention according to claim 13 refers to the information recording apparatus according to claim 11, wherein the second resuming means resumes the background formatting when a recording area requested by the user is reallocated to the spare area and the data in the spare area is updated by recording performed in the spare area.

[0054]

Accordingly, when the spare area is updated by the recording performed in the spare area, the background formatting is resumed. Thus the incorrect spare data may be prevented from being recorded in the temporary spare area of the information recording medium due to cutoff of the electrical source of the drive device before the temporary spare area is updated.

[0055]

The invention according to claim 14 refers to the information recording apparatus according to claim 11, wherein the second resuming means resumes the background formatting when a defect area is newly detected in the user data area and the data in the spare area is reallocated to another spare area.

[0056]

Accordingly, when a defect area is newly detected in the user data area and the data in the spare area is reallocated to another spare area, the background formatting is resumed. Thus the incorrect spare data may be prevented from being recorded in the temporary spare area of the information recording medium due to cutoff of the electrical source of the drive device before the temporary spare area is updated.

[0057]

The invention according to claim 15 refers to the information recording apparatus according to claim 10, wherein the information recording medium is an information recording medium according to the DVD + MRW standard, the spare area is a Spare Area 2, the temporary spare area is a Temporary Spare Area 2, and the first resuming means resumes the background formatting when the data in the Temporary Spare Area 2 is changed.

[0058]

Accordingly, effect according to the invention described in claim 10 may be achieved in the information recording medium according to the DVD + MRW standard.

[0059]

The invention according to claim 16 refers to the information recording apparatus according to claim 11, wherein the information recording medium is an information recording medium according to the DVD + MRW standard, the spare area is a Spare Area 2, the temporary spare area is a Temporary Spare Area 2, and the second resuming means resumes the background formatting when the data in the Spare Area 2 is changed.

[0060]

Accordingly, effect according to the invention described in claim 11 may be achieved in the information recording medium according to the DVD + MRW standard.

[0061]

The invention according to claim 17 refers to an information recording method, using hardware resources, for executing an information recording step of recording data on an information recording medium including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area, a data reallocating step of reallocating the data to the spare area, a temporary spare area recording step of generating a temporary spare area by temporarily copying the data in the spare area to the user data area, and a fist updating step of updating the temporary spare area by copying the data in the spare area to another user data area when the data in the temporary spare area is changed.

[0062]

Accordingly, when the data in the temporary spare area is changed, data in the spare area is copied to another user data area. Thus, the temporary spare area may be updated and correct spare data may be always recorded in the temporary spare area.

[0063]

The invention according to claim 18 refers to an information recording method, using hardware resources, for executing an information recording step of recording data on an information recording medium including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area, a data reallocating step of reallocating the data to the spare area, a temporary spare area recording step of generating a temporary spare area by temporarily copying the data in the spare area to the user data area, and a second updating step of updating the temporary spare area by copying the data in the spare area to another user data area when the data in the spare area is changed.

[0064]

Accordingly, when the spare area is updated, data in the spare area is copied to another user data area. Thus, the temporary spare area may be updated and correct spare data may be always recorded in the temporary spare area.

[0065]

The invention according to claim 19 refers to an information recording method, using hardware resources, for executing an information recording step of recording data on an information recording medium including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area, a background formatting step of formatting the information recording medium in a background, a background formatting resuming step of resuming background formatting when the information recording medium is partially formatted, a data reallocating step of reallocating the data to the spare area, a temporary spare area recording step of generating a temporary spare area by temporarily copying the data in the spare area to the user data area, and a first resuming step of resuming the background formatting when the data in the temporary spare area is changed.

[0066]

An electrical source of the information recording apparatus (drive device) may be cut off without the information recording medium (optical disk) being ejected after the temporary spare area (TSA2) is overwritten by user data or after the spare area (SA2) is updated. In this case, the temporary spare area (TSA2) may not be updated and a problem such that the incorrect spare data is left recorded may occur. Such a problem may be prevented from occurring by resuming the background formatting when it is necessary to update the temporary spare area (TSA2). When the information recording medium (optical disk) halfway through the formatting is inserted in a DVD + MRW, a host apparatus monitoring formatting status is designed to suspend the background formatting when a user request for disk ejection or a request for cutting off the electrical source for a computer is made during the background formatting. In other words, when the background formatting is resumed at a time of the user records the data in the temporary spare area (TSA2), for instance, the host apparatus is to monitor the user request for disk ejection or the request for cutting off the electrical source for the computer, and is to issue a request for formatting suspension to the information recording apparatus (drive device) upon request. Accordingly, the information recording apparatus (drive device) may perform the updating processing of the temporary spare area (TSA2) at a time of receiving a request for background formatting suspension. In addition, when the request for formatting suspension is not made, data is recorded up to a position of an original spare area (SA2), preventing incorrect spare data from being recorded. Thus, the information recording medium (optical disk) with the incorrect spare data may be prevented from being ejected. As described above, the background formatting is resumed when it is necessary to update the temporary spare area. Thus the incorrect spare data may be prevented from being recorded in the temporary spare area of the information recording medium due to cutoff of the electrical source of the drive device before the temporary spare area is updated.

[0067]

The invention according to claim 20 refers to an information recording method, using hardware resources, for executing an information recording step of recording data on an information recording medium including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area, a background formatting step of formatting the information recording medium in a background, a background formatting resuming step of resuming background formatting when the information recording medium is partially formatted, a data reallocating step of reallocating the data to the spare area, a temporary spare area recording step of generating a temporary spare area by temporarily copying the data in the spare area to the user data area, and a second resuming step of resuming the background formatting when the data in the spare area is changed.

[0068]

An electrical source of the information recording apparatus (drive device) may be cut off without the information recording medium (optical disk) being ejected after the temporary spare area (TSA2) is overwritten by user data or after the spare area (SA2) is updated. In this case, the temporary spare area (TSA2) may not be updated and a problem such that the incorrect spare data is left recorded may occur. Such a problem may be prevented from occurring by resuming the background formatting when it is necessary to update the temporary spare area (TSA2). When the information recording medium (optical disk) halfway through the formatting is inserted in a DVD + MRW, a host apparatus monitoring formatting status is designed to suspend the background formatting when a user request for disk ejection or a request for cutting off the electrical source for a computer is made during the background formatting. In other words, when the background formatting is resumed at a time of the user records the data in the temporary spare area (TSA2), for instance, the host apparatus is to monitor the user request for disk ejection or the request for cutting off the electrical source for the computer, and is to issue a request for formatting suspension to the information recording apparatus (drive device) upon request. Accordingly, the information recording apparatus (drive device) may perform the updating processing of the temporary spare area (TSA2) at a time of receiving a request for background formatting suspension. In addition, when the request for formatting suspension is not made, data is recorded up to a position of an original spare area (SA2), preventing incorrect spare data from being recorded. Thus, the information recording medium (optical disk) with the incorrect spare data may be prevented from being ejected. As described above, the background formatting is resumed when it is necessary to update the spare area. Thus the incorrect spare data may be prevented from being recorded in the temporary spare area of the information recording medium due to cutoff of the electrical source of the drive device before the temporary spare area is updated.

[0069]

The invention according to claim 21 refers to a machine-readable program for recording information installed in a computer, for causing the computer to execute an information recording step of recording data on an information recording medium including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area, a data reallocating step of reallocating the data to the spare area, a temporary spare area recording step of generating a temporary spare area by temporarily copying the data in the spare area to the user data area, and a first updating step of updating the temporary spare area by copying the data in the spare area to another user data area when the data in the temporary spare area is changed.

[0070]

Accordingly, when the data in the temporary spare area is changed, data in the spare area is copied to another user data area. Thus, the temporary spare area may be updated and correct spare data may be always recorded in the temporary spare area.

[0071]

The invention according to claim 22 refers to a machine-readable program for recording information installed in a computer, for causing the computer to execute an information recording step of recording data on an information recording medium including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area, a data reallocating step of reallocating the data to the spare area, a temporary spare area recording step of generating a temporary spare area by temporarily copying the data in the spare area to the user data area, and a second updating step of updating the temporary spare area by copying the data in the spare area to another user data area when the data in the spare area is changed.

[0072]

Accordingly, when the spare area is updated, data in the spare area is copied to another user data area. Thus, the temporary spare area may be updated and correct spare data may be always recorded in the temporary spare area.

[0073]

The invention according to claim 23 refers to a machine-readable program for recording information installed in a computer, for causing the computer to execute an information recording step of recording data on an information recording medium including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area, a background formatting step of formatting the information recording medium in a background, a background formatting resuming step of resuming background formatting when the information recording medium is partially formatted, a data reallocating step of reallocating the data to the spare area, a temporary spare area recording step of generating a temporary spare area by temporarily copying the data in the spare area to the user data area, and a first resuming step of resuming the background formatting when the data in the temporary spare area is changed.

[0074]

An electrical source of the information recording apparatus (drive device) may be cut off without the information recording medium (optical disk) being ejected after the temporary spare area (TSA2) is overwritten by user data or after the spare area (SA2) is updated. In this case, the temporary spare area (TSA2) may not be updated and a problem such that the incorrect spare data is left recorded may occur. Such a problem may be prevented from occurring by resuming the background formatting when it is necessary to update the temporary spare area (TSA2). When the information recording medium (optical disk) halfway through the formatting is inserted in a DVD + MRW, a host apparatus monitoring formatting status is designed to suspend the background formatting when a user request for disk ejection or a request for cutting off the electrical source for a computer is made during the background formatting. In other words, when the background formatting is resumed at a time of the user records the data in the temporary spare area (TSA2), for instance, the host apparatus is to monitor the user request for disk ejection or the request for cutting off the electrical source for the computer, and is to issue a request for formatting suspension to the information recording apparatus (drive device) upon request. Accordingly, the information recording apparatus (drive device) may perform the updating processing of the temporary spare area (TSA2) at a time of receiving a request for background formatting suspension. In addition, when the request for formatting suspension is not made, data is recorded up to a position of an original spare area (SA2), preventing incorrect spare data from being recorded. Thus, the information recording medium (optical disk) with the incorrect spare data may be prevented from being ejected. As described above, the background formatting is resumed when it is necessary to update the temporary spare area. Thus the incorrect spare data may be prevented from being recorded in the temporary spare area of the information recording medium due to cutoff of the electrical source of the drive device before the temporary spare area is updated.

[0075]

The invention according to claim 24 refers to a machine-readable program for recording information installed in a computer, for causing the computer to execute an information recording step of recording data on an information recording medium including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area, a background formatting step of formatting the information recording medium in a background, a background formatting resuming step of resuming background formatting when the information recording medium is partially formatted, a data reallocating step of reallocating the data to the spare area, a temporary spare area recording step of generating a temporary spare area by temporarily copying the data in the spare area to the user data area, and a second resuming step of resuming the background formatting when the data in the spare area is changed.

[0076]

An electrical source of the information recording apparatus (drive device) may be cut off without the information recording medium (optical disk) being ejected after the temporary spare area (TSA2) is overwritten by user data or after the spare area (SA2) is updated. In this case, the temporary spare area (TSA2) may not be updated and a problem such that the incorrect spare data is left recorded may occur. Such a problem may be prevented from occurring by resuming the background formatting when it is necessary to update the temporary spare area (TSA2). When the information recording medium (optical disk) halfway through the formatting is inserted in a DVD + MRW, a host apparatus monitoring formatting status is designed to suspend the background formatting when a user request for disk ejection or a request for cutting off the electrical source for a computer is made during the background formatting. In other words, when the background formatting is resumed at a time of the user records the data in the temporary spare area (TSA2), for instance, the host apparatus is to monitor the user request for disk ejection or the request for cutting off the electrical source for the computer, and is to issue a request for formatting suspension to the information recording apparatus (drive device) upon request. Accordingly, the information recording apparatus (drive device) may perform the updating processing of the temporary spare area (TSA2) at a time of receiving a request for background formatting suspension. In addition, when the request for formatting suspension is not made, data is recorded up to a position of an original spare area (SA2), preventing incorrect spare data from being recorded. Thus, the information recording medium (optical disk) with the incorrect spare data may be prevented from being ejected. As described above, the background formatting is resumed when it is necessary to update the temporary spare area. Thus the incorrect spare data may be prevented from being recorded in the temporary spare area of the information recording medium due to cutoff of the electrical source of the drive device before the temporary spare area is updated.

[0077]

The invention according to claim 25 refers to a storage medium for storing the program for recording information according to claims 21 through 24.

[0078]

Accordingly, same operational effect as the operational effect achieved in the program for recording information according to any one of claims 21 through 24 may be achieved.

[0079]

The invention according to claim 26 refers to an information recording system, including an information recording apparatus for recording data on an information recording medium and including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area, and a host apparatus which instructs the information recording apparatus to perform an information recording operation, wherein either one of or both of the information recording apparatus and the host apparatus include as a whole an information recording means for recording data on the information recording medium, a data reallocating means for reallocating the data to the spare area, a temporary spare area recording means for generating a temporary spare area by temporarily copying the data in the spare area to the user data area, and a first updating means for updating the temporary spare area by copying the data in the spare area to another user data area when the data in the temporary spare area is changed.

[0080]

Accordingly, when the data in the temporary spare area is changed, data in the spare area is copied to another user data area. Thus, the temporary spare area may be updated and correct spare data may be always recorded in the temporary spare area.

[0081]

The invention according to claim 27 refers to an information recording system, including an information recording apparatus for recording data on an information recording medium and including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area, and a host apparatus for instructing the information recording apparatus to perform an information recording operation, wherein any one of or both of the information recording apparatus and the host apparatus include as a whole an information recording means for recording data on the information recording medium, a data reallocating means for reallocating the data to the spare area, a temporary spare area recording means for generating a temporary spare area by temporarily copying the data in the spare area to the user area, and a second updating means for updating the temporary spare area by copying the data in the spare area to another user data area when the data in the spare area is changed.

[0082]

Accordingly, when the spare area is updated, data in the spare area is copied to another user data area. Thus, the temporary spare area may be updated and correct spare data may be always recorded in the temporary spare area.

[0083]

The invention according to claim 28 refers to an information recording system including an information recording apparatus for recording data on an information recording medium and including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area, and a host apparatus for instructing the information recording apparatus to perform an information recording operation, wherein any one of or both of the information recording apparatus and the host apparatus include as a whole an information recording means for recording data on the information recording medium, a background formatting means for formatting the information recording medium in a background, a background formatting resuming means for resuming background formatting when the information recording medium is partially formatted, a data reallocating means for reallocating the data to the spare area, a temporary spare area recording means for generating a temporary spare area by temporarily copying the data in the spare area to the user data area, and a first resuming means for resuming the background formatting when the data in the temporary spare area is changed.

[0084]

An electrical source of the information recording apparatus (drive device) may be cut off without the information recording medium (optical disk) being ejected after the temporary spare area (TSA2) is overwritten by user data or after the spare area (SA2) is updated. In this case, the temporary spare area (TSA2) may not be updated and a problem such that the incorrect spare data is left recorded may occur. Such a problem may be prevented from occurring by resuming the background formatting when it is necessary to update the temporary spare area (TSA2). When the information recording medium (optical disk) halfway through the formatting is inserted in a DVD + MRW, a host apparatus monitoring formatting status is designed to suspend the background formatting when a user request for disk ejection or a request for cutting off the electrical source for a computer is made during the background formatting. In other words, when the background formatting is resumed at a time of the user records the data in the temporary spare area (TSA2), for instance, the host apparatus is to monitor the user request for disk ejection or the request for cutting off the electrical source for the computer, and is to issue a request for formatting suspension to the information recording apparatus (drive device) upon request. Accordingly, the information recording apparatus (drive device) may perform the updating processing of the temporary spare area (TSA2) at a time of receiving a request for background formatting suspension. In addition, when the request for formatting suspension is not made, data is recorded up to a position of an original spare area (SA2), preventing incorrect spare data from being recorded. Thus, the information recording medium (optical disk) with the incorrect spare data may be prevented from being ejected. As described above, the background formatting is resumed when it is necessary to update the temporary spare area. Thus the incorrect spare data may be prevented from being recorded in the temporary spare area of the information recording medium due to cutoff of the electrical source of the drive device before the temporary spare area is updated.

[0085]

The invention according to claim 29 refers to an information recording system, including an information recording apparatus for recording data on an information recording medium and including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area, and a host apparatus for instructing the information recording apparatus to perform an information recording operation, wherein any one of or both of the information recording apparatus and the host apparatus include as a whole an information recording means for recording data on the information recording medium, a background formatting means for formatting the information recording medium in a background, a background formatting resuming means for resuming background formatting when the information recording medium is partially formatted, a data reallocating means for reallocating the data to the spare area, a temporary spare area recording means for generating a temporary spare area by copying the data in the spare area to the user data area, and a second resuming means for resuming the background formatting when the data in the spare area is changed.

[0086]

An electrical source of the information recording apparatus (drive device) may be cut off without the information recording medium (optical disk) being ejected after the temporary spare area (TSA2) is overwritten by user data or after the spare area (SA2) is updated. In this case, the temporary spare area (TSA2) may not be updated and a problem such that the incorrect spare data is left recorded may occur. Such a problem may be prevented from occurring by resuming the background formatting when it is necessary to update the temporary spare area (TSA2). When the information recording medium (optical disk) halfway through the formatting is inserted in a DVD + MRW, a host apparatus monitoring formatting status is designed to suspend the background formatting when a user request for disk ejection or a request for cutting off the electrical source for a computer is made during the background formatting. In other words, when the background formatting is resumed at a time of the user records the data in the temporary spare area (TSA2), for instance, the host apparatus is to monitor the user request for disk ejection or the request for cutting off the electrical source for the computer, and is to issue a request for formatting suspension to the information recording apparatus (drive device) upon request. Accordingly, the information recording apparatus (drive device) may perform the updating processing of the temporary spare area (TSA2) at a time of receiving a request for background formatting suspension. In addition, when the request for formatting suspension is not made, data is recorded up to a position of an original spare area (SA2), preventing incorrect spare data from being recorded. Thus, the information recording medium (optical disk) with the incorrect spare data may be prevented from being ejected. As described above, the background formatting is resumed when it is necessary to update the spare area. Thus the incorrect spare data may be prevented from being recorded in the temporary spare area of the information recording medium due to cutoff of the electrical source of the drive device before the temporary spare area is updated.

[0087]

[Description of the Preferred Embodiments]

One embodiment of the present invention is described based on Fig. 1 through Fig. 6. In the figures, same parts as parts described based on Fig. 7 through Fig. 9 are referred to by the same numerals, and a description thereof is omitted.

[0088]

In the embodiment, an information recording apparatus according to the present invention is used in an optical disk device. Fig. 1 is a frame format illustrating an example of a configuration of the optical disk device.

[0089]

[Basic configuration]

As illustrated in Fig. 1, an optical disk drive 101 includes a drive device 102 which is hardware resources for performing recording/reproducing of information on/from an optical disk, and a driver 103 for the drive device 102. In this case, instead of an MRW drive device 102, a conventional driver device 102 may be used as the drive device 102. At the same time, the driver 103 is a driver according to the Mr. Rainier standard.

[0090]

The drive device 102 rotates an optical disk 104 which is an information recording medium such as a DVD + MRW or a DVD + RW in the embodiment and performs recording/reproducing of information by irradiating a laser beam on the rotating optical disk 104. For this purpose, the drive device 102 is formed of parts such as a motor 105 for rotating/driving the optical disk 104, an optical pickup 106 for irradiating the laser beam on the optical disk 104, and a motor 107 for moving the optical pickup 106 in a radius direction of the optical disk 104. The drive device 102 further includes a control system for controlling each part as described above.

[0091]

As a control system, the drive device 102 includes a controller 108 for centrally controlling the each part, and further includes a rotation control system 109, a pickup control system 110, a motor control system 111, and a signal processing system 112 which are controlled by the controller 108. The rotation control system 109 controls an operation of the motor 105 which rotates/drives the optical disk 104. The pickup control system 110 controls an operation of the optical pickup 106 which irradiates a laser beam on the optical disk 104. The motor control system 111 controls an operation of the motor 107 which causes the optical pickup 106 to move in the radius direction of the optical disk 104. The signal processing system 112 receives a laser beam by a light receiving element, not shown. The laser beam is irradiated from the optical pickup 106 controlled by the pickup control system 110 and reflected by the optical disk 104. The signal processing system 112 is designed to perform processing on a received light signal. The signal processing system 112 stores data read from the optical disk 104 in a cache memory 113. The controller 108 transfers the data stored in the cache memory 113 to a host apparatus 115 connected via an external interface 114.

[0092]

The rotation control system 109, the pickup control system 110, the motor control system 111, and the signal processing system 112 configuring the above described control systems are formed of a digital circuit, for instance.

[0093]

At the same time, the controller 108 included in the drive device 102 is built by a microcomputer, for instance. In the controller 108 formed of the microcomputer, a program for recording information

116 configuring the driver 103 of the drive device 102 is installed. The program for recording information 116 may be fixedly recorded on a recording medium included in the controller 108 such as an ROM, or may be recorded in a rewritable manner on a battery backup RAM, a nonvolatile memory, and so forth.

[0094]

Another embodiment of a method of storing the driver 103 for the drive device 102 is described below. As illustrated in Fig. 2, the program for recording information 116 configuring the driver 103 may be installed in a program storing area 117 provided in the host apparatus 115 (refer to Fig. 2(a)), or may be included in an OS 118 of the host apparatus 115 (refer to Fig. 2(b)). Alternatively, a part of the program for recording information 116 may be included in the OS 118 of the host apparatus 115 (refer to Fig. 2(c)). In another embodiment of a method of storing the driver 103 for the drive device 102 as illustrated in Fig. 2, the drive device 102 and the host apparatus 105 configure an information recording system.

[0095]

[Basic operation]

In such a configuration, the controller 108 drives/controls the drive device 102 according to the program for recording information 116 configuring the driver 103 and causes the optical pickup 106 to irradiate a laser beam on the optical disk 104. Data is thus recorded on the optical disk 104 serving as an information recording medium (information recording means, information recording step).

[0096]

In a case of the driver 103 according to the Mr. Rainier standard as in the embodiment, defect management information or information about formatting status is recorded in an MTA or in an STA in a DVD + MRW serving as the optical disk 104. The STA is a copy of what is stored in the MTA and is arranged in a Data Zone. When a defect is detected in a DA during data recording, an area in which the data is recorded is reallocated to an SA serving as a spare area (data reallocating means, data reallocating step).

[0097]

As described above, by arranging the STA which is a defect management area and the SA which is a spare area in the Data Zone which is accessible by the conventional drive device 102, the conventional drive device may read including the spare area.

[0098]

In addition, the program for recording information 116 configuring the driver 103 according to the embodiment performs background formatting. In the background formatting, a user making a formatting request is notified of a formatting completion message after recording only a portion of a Lead in Zone, and remaining portions of the Lead in Zone are recorded with dummy data when there is no access from the user (background formatting means, background formatting step).

[0099]

After being notified of the formatting completion message, the user may randomly record/reproduce data in all user data areas on the optical disk 104.

[0100]

During such background formatting, the optical disk 104 may be removed before recording of whole area of the optical disk 104 is completed. In a case of removing the optical disk 104 during the background formatting, the program for recording information 116 configuring the driver 103 records an unrecorded area existing between recorded data with the dummy data so as to cause the conventional drive device 102 to properly read the partially-formatted optical disk 104. Then in order for the driver 103 to obtain the defect management information, a TSTA is recorded from an LWA recorded with user data or by formatting. Finally, the disk is ejected after recording TLO on the disk (background formatting resuming means, background formatting resuming step).

[0101]

On the other hand, in a case of the DVD + MRW, since the spare areas exist only in the SA1 and the SA 2, the SA2 may be used during the background formatting. When the SA2 is used, it is necessary to record dummy data in an area from a formatted area to the SA2 to cause the conventional drive device 102 to read the data reallocated to the SA2. However, since the SA2 exists at the very end of the user data area, the optical disk 104 which is to be replaced with the SA2 may not be practically removed until the formatting is completed. To avoid such a problem, in the DVD + MRW as illustrated in Fig. 8(b), data reallocated to the SA2 is copied to the TSA2 located after the formatted area. The disk is then ejected after recording the TSTA and the TLO followed by the TSA2 (temporary spare area recording means, temporary spare area recording step).

[0102]

[Update Processing of Temporary Spare Area (TSA2)]

However, depending on various kinds conditions described below, uniformity between the SA2 and the TSA2 may not be maintained. In such a case, a user accessing the optical disk 104 may be given incorrect information. In the embodiment, the update processing of TSA2 is performed to deal with the problem.

[0103]

The update processing of the TSA2 performed by the driver 103 according to the embodiment is described below with reference to Fig. 3, Fig. 4, and Fig. 9. The description is given by referring to a case in which a user performs data recording in the TSA2.

[0104]

Fig. 3(a) is a drawing illustrating a case in which the TSA2 is overwritten with user data as a result of a user performing data recording on a DVD + MRW, that is, the partially formatted optical disk 104. In other words, a hatched area in Fig. 3(a) represents an overwritten area, which partially covers the TSA2.

[0105]

For this reason, the TSA2 remains being overwritten. When the optical disk 104 on which such TSA2 is overwritten with the user data is inserted into the conventional drive device 102, a problem such that the conventional drive device gives incorrect spare data to the user occurs. That is, when the TSA2 is overwritten with the user data in processing of adding the user data on the partially formatted optical disk 104, there is a case in which the TSA2 does not correctly reflect information of the SA2. Accordingly, when such an optical disk 104 is inserted into the conventional drive device 102, incorrect information may be given to the user.

[0106]

In the embodiment, as illustrated in Fig. 3(b), the controller 108 performs processing according to the program for recording information 116 configuring the driver 103. In a case of the TSA2 is overwritten with the user data, the TSA2 copied from the SA2 is recorded on the optical disk 104 from a position of an LWA at predetermined timing, followed by recording of the TSTA and the TLO (first updating means).

[0107]

Even when a user performs data recording on the TSA2, information of the TSA2 may be thus prevented from being lost by being overwritten with the user data.

[0108]

Fig. 3 is a drawing illustrating an assumed situation in which the TSA2 is overwritten with the user data as a result of a user performing data recording on a DVD + MRW which is a partially formatted optical disk 104. In the embodiment, a problem of occurrence of such a situation, that is, a situation when the TSA2 does not correctly reflect information of the SA2 is prevented from occurring.

[0109]

At the same time, a situation in which the TSA2 does not correctly reflect the information of the SA2 also arises when data of the SA2 is updated. The data of the SA2 is updated when a user performs data recording in an area reallocated to the SA2 or when a defect area is newly detected during recording of the user data.

[0110]

According to the embodiment, even when such a situation arises, the controller 108 performs processing according to the program for recording information 116 configuring the driver 103, and the TSA2 copied from the SA2 is recorded on the optical disk 104 from a position of an LWA at predetermined timing, followed by recording of the TSTA and the TLO (second updating means).

[0111]

Thus a situation in which the TSA2 does not correctly reflect the information of the SA2 is prevented from arising.

[0112]

A flow of updating processing of the TSA2 performed by the controller 108 according to the program for recording information 116 configuring the above-described driver 103 is described below with reference to a flowchart in Fig. 4.

[0113]

Data recording is performed (step S2) when a data recording request is issued from a user (step S1). If a recording area requested by the user is reallocated to the SA2, the data is recorded in the SA2.

[0114]

Next, a determination is performed as to whether or not a requested address is in the TSA2 (step S3). When the requested address is in the TSA2, a TSA2 update flag is set (step S6).

[0115]

When it is determined in step S3 that the requested address is not in the TSA2, a determination is further made as to whether the requested address is reallocated to the SA2 (step S4). When the requested address is reallocated to the SA2, the TSA2 update flag is set (step S6).

[0116]

When it is determined in step S4 that the requested address is not reallocated to the SA2, a determination is further made as to whether the recording on the requested address caused another reallocation to the SA2 (step S5). When a reallocation to the SA2 is newly occurred, the TSA2 update flag is set (step S6).

[0117]

On the other hand, when the data recording request is not issued from the user in step S1, a check is further made as to whether a request for ejecting the optical disk 104 is made (step S7). When the request for ejecting the optical disk 104 is made (step S7/Y), a check is made as to whether the TSA2 update flag is set (step S8). If the TSA2 update flag is not set, the disk is discharged to complete processing (step S11). When the TSA2 update flag is set, the TSA2 is newly recorded from the LWA (step S9), followed by recording of the TSTA and the TLO (step S10). Then the disk is discharged to complete the processing (step S11).

[0118]

As described above, in the embodiment, the updating processing of the TSA2 is performed at timing of when a request for ejecting the optical disk 104 is made from a user. Thus performance of a user request for data recording may be prevented from being degraded due to the update processing of TSA2 serving as a temporary spare area.

[0119]

As an alternative example of update timing of the TSA2, the TSA2 may be updated at a time when a request for formatting suspension is made. In this case, determination processing in step S7 as to whether or not an eject request is made is replaced by determination processing as to whether or not the formatting suspension is made.

[0120]

[Resuming Processing of Background Formatting]

When a user performs data recording in the TSA2, the program for recording information 116 configuring the driver 103 according to the embodiment resumes the background formatting (first resuming means).

[0121]

As illustrated in Fig. 3(c), when resuming the background formatting, recording of dummy data is started from an LWA (TLO start address). When such an optical disk 104 is again removed, the host apparatus 115 issues a request for formatting suspension. In response to the request for formatting suspension, the drive device 102 records the TSA2, the TSTA, and the TLO from a new LWA at a time of receiving the request for formatting suspension, before ejecting the optical disk 104. In addition, when a user does not make a request for formatting suspension, original SA2, STA, LO are to be recorded.

[0122]

As described above, even when a user performs data recording on the TSA2, information of the TSA2 may be prevented from being lost by being overwritten with the user data.

[0123]

Fig. 3(C) is a drawing illustrating an assumed situation in which the TSA2 is overwritten with the user data as a result of a user performing data recording on a DVD + MRW, that is, the partially formatted optical disk 104. In the embodiment, a problem of occurrence of such a situation, that is, a situation when the TSA2 does not correctly reflect information of the SA2 is prevented from occurring.

[0124]

At the same time, a situation in which the TSA2 does not correctly reflect the information of the SA2 also arises when data of the SA2 is updated. The data of the SA2 is updated when a user performs data recording in an area reallocated to the SA2 or when a defect area is newly detected during recording of the user data.

[0125]

According to the embodiment, even when such a situation arises, the controller 108 performs processing according to the program for recording information 116 configuring the driver 103. Thus, resuming processing of the background formatting as illustrated in Fig. 3(C) is performed. In other words, when resuming the background formatting, recording of dummy data is resumed from an LWA (TLO start address). When such an optical disk 104 is again removed, the host apparatus 115 issues a request for formatting suspension. In response to the request for formatting suspension, the drive device 102 records the TSA2, the TSTA, and the TLO from a new LWA at a time of receiving the request for formatting suspension, before ejecting the optical disk 104 (second resuming means).

[0126]

A flow of resuming processing of the background formatting performed by the controller 108 according to the program for recording information 116 configuring the above-described driver 103 is described below with reference to a flowchart in Fig. 5.

[0127]

Data recording is performed (step S22) when a data recording request is issued from a user (step S21). If a recording area requested by the user is reallocated to the SA2, the data is recorded in the SA2.

[0128]

Next, a determination is performed as to whether or not a requested address is in the TSA2 (step S23). When the requested address is in the TSA2 (step S23/Y), the background formatting is resumed (step S26).

[0129]

When it is determined that the requested address is not in the TSA2 (step S23/N), a determination is further made as to whether the requested address is reallocated to the SA2 (step S24). When the requested address is reallocated to the SA2 (step S24/Y), the background formatting is resumed (step S26).

[0130]

When it is determined in step S4 that the requested address is not reallocated to the SA2 (step S24/N), a determination is further made as to whether the recording on the requested address caused another reallocation to the SA2 (step S25). When a reallocation to the SA2 is newly occurred (step S27/Y), the background formatting is resumed (step S26).

[0131]

On the other hand, when the data recording request is not issued from the user in step S21 (step S21/N), a check is further made as to whether a request for background formatting suspension is made (step S27). When the formatting suspension request is issued (step S27/Y), a check is made as to whether or not the background formatting is underway (step S28).

[0132]

If it is determined that the background formatting is not underway, the processing is completed (step S28/N), whereas if it is determined that the background formatting is underway (step S28/Y), the background formatting is suspended (step S29). Then the TSA2 is newly recorded from the LWA (step S30), and the TSTA and the TLO are recorded followed by the TSA2 (step S31) to complete the processing.

[0133]

[Reproduction Processing]

In the reproduction processing, data recorded on the optical disk 104, that is an MRW disk, is read by a combined action of the conventional drive device 102 and the MRW driver (reader driver).

[0134]

In processing of the controller 108 according to the program for recording information 116 configuring the driver 106, it is determined whether or not the optical disk 104 is the MRW disk (step S41). The determination processing is performed by referring to a GAA (refer to Fig. 7) included in a DA of the optical disk.

[0135]

When it is determined that the optical disk 104 is not the MRW disk (step S41/N), the reproduction processing is performed pending a user request for reproduction (step S49 through 52).

[0136]

At the same time, when it is determined that the optical disk 104 is the MRW disk (step S41/Y), the TSA and the TSA2 functioning as spare information are obtained (step S45) by going through processing of searching for a TLO start address (step S42), searching for a TSTA start address (step S43), and reading of a TSTA (step S44). Then mounting of the MRW driver is completed (step S46). The reproduction processing is then performed pending the user request for reproduction (step S49 through 52).

[0137]

In the reproduction processing, a determination is made as to whether there is any reallocated data in the DA (step S48). If there is no reallocated data, the reproduction processing is continued until its completion (step S52).

[0138]

At the same time, if there is reallocated data in the DA, the data is converted into a reallocation address (step S49). The allocation address is then read (step S50), and the reproduction processing is continued until its completion (step S52).

[0139]

[Effects of the Invention]

The invention according to claim 1 refers to an information recording apparatus, including an information recording means for recording data on an information recording medium including a user data area for recording data requested by a user and a spare area for reallocating a defect exiting in the user data area, a data reallocating means for reallocating the data to the spare area, a temporary spare area recording means for generating a temporary spare area by temporarily copying the data in the spare area to the user data area, and a first updating means for updating the temporary spare area by copying the data in the spare area to another user data area when the data in the temporary spare area is changed. Accordingly, when the data in the temporary spare area is changed, data in the spare area is copied to another user data area. Thus the temporary spare area may be updated and correct spare data may be always recorded in the temporary spare area.

[0140]

The invention according to claim 2 refers to an information recording apparatus, including an information recording means for recording data on an information recording medium including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area, a data reallocating means for reallocating the data to the spare area, a temporary spare area recording means for generating a temporary spare area by temporarily copying the data in the spare area to the user data area, and a second updating means for updating the temporary spare area by copying the data in the spare area to another user data area when the data in the spare area is changed. Accordingly, when the spare area is updated, data in the spare area is copied to another user data area. Thus, the temporary spare area may be updated and correct spare data may be always recorded in the temporary spare area.

[0141]

The invention according to claim 3 refers to the information recording apparatus according to claim 1, wherein the first updating means updates the temporary spare area when the temporary spare area is overwritten by user data. Accordingly, when the temporary spare area is overwritten by the user data, data in the spare area is copied to another user data area. Thus, the temporary spare area may be updated and correct spare data may be always recorded in the temporary spare area.

[0142]

The invention according to claim 4 refers to the information recording apparatus according to claim 2, wherein the second updating means updates the temporary spare area when a recording area requested by the user is reallocated to the spare area and the data in the spare area is updated by recording performed in the spare area. Accordingly, when the spare area is updated by recording performed in the spare area, data in the spare area is copied to another user data area. Thus, the temporary spare area may be updated and correct spare data may be always recorded in the temporary spare area.

[0143]

The invention according to claim 5 refers to the information recording apparatus according to claim 2, wherein the second updating means updates the temporary spare area when a defect area is newly detected in the user data area and the data in the spare area is reallocated in another spare area. Accordingly, when a defect area is newly detected in the user data area and the data in the spare area is reallocated in another spare area, data in the spare area is copied to another user data area. Thus, the temporary spare area may be updated and correct spare data may be always recorded in the temporary spare area.

[0144]

The invention according to claim 6 refers to the information recording apparatus according to claim 1, wherein the information recording medium is an information recording medium according to a DVD + MRW standard, the spare area is a Spare Area 2, the temporary spare area is a Temporary Spare Area 2, and the first updating means records a Temporary Secondary Table Area and Temporary Lead Out after recording another Temporary Spare Area 2 in an area followed by a Last Written Address when data of the Temporary Spare Area is changed. Accordingly, effect according to the invention described in claim 1 may be achieved in the information recording medium according to the DVD + MRW standard.

[0145]

The invention according to claim 7 refers to the information recording apparatus according to claim 2, wherein the information recording medium is an information recording medium according to the DVD + MRW standard, the spare area is a Spare Area 2, the temporary spare area is a Temporary Spare Area 2, and the second updating means records a Temporary Secondary Table Area and Temporary Lead Out after recording another Temporary Spare Area 2 in an area followed by a Last Written Address when data of the Spare Area 2 is changed. Accordingly, effect according to the invention described in claim 1 may be achieved in the information recording medium according to the DVD + MRW standard.

[0146]

The invention according to claim 8 refers to the information recording apparatus according to any one of claims 1 through 7, wherein the updating means performs ejection upon receiving a request for ejecting the information recording medium from the user. Since the temporary spare area is updated only at a time when the information recording medium is being ejected, updating processing of the temporary spare area may be prevented from lowering performance of a user request for data recording. In addition, since the data of the temporary spare area is properly recorded in the ejected information recording medium, the spare data may be read by the conventional drive device without fail.

[0147]

The invention according to claim 9 refers to the information recording apparatus according to any one of claims 1 through 7, wherein the updating means performs formatting suspension upon receiving a request for formatting suspension from the user. Since the temporary spare area is updated only at a time of receiving the request for formatting suspension from the user, updating processing of the temporary spare area may be prevented from lowering performance of a user request for data recording. In addition, since the data of the temporary spare area is properly recorded in the ejected information recording medium, the spare data may be read by the conventional drive device without fail.

[0148]

The invention according to claim 10 refers to an information recording apparatus, including an information recording means for recording data on an information recording medium including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area, a background formatting means for formatting the information recording medium in a background, a background formatting resuming means for resuming background formatting when the information recording medium is partially formatted, a data reallocating means for reallocating the data to the spare area, a temporary spare area recording means for generating a temporary spare area by temporarily copying the data in the spare area to the user data area, and a first resuming means for resuming the background formatting when the data in the temporary spare area is changed. As described above, the background formatting is resumed when it is necessary to update the temporary spare area. Thus the incorrect spare data may be prevented from being recorded in the temporary spare area of the information recording medium due to cutoff of the electrical source of the drive device before the temporary spare area is updated.

[0149]

The invention according to claim 11 refers to an information recording apparatus, including an information recording means for recording data on an information recording medium including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area, a background formatting means for formatting the information recording medium in a background, a background formatting resuming means for resuming background formatting when the information recording medium is partially formatted, a data reallocating means for reallocating the data to the spare area, a temporary spare area recording means for generating a temporary spare area by temporarily copying the data in the spare area to the user data area, and a second resuming means for resuming the background formatting when the data in the spare area is changed. As described above, the background formatting is resumed when it is necessary to update the spare area. Thus the incorrect spare data may be prevented from being recorded in the temporary spare area of the information recording medium due to cutoff of the electrical source of the drive device before the temporary spare area is updated.

[0150]

The invention according to claim 12 refers to the information recording apparatus according to claim 10, wherein the first resuming means resumes the background formatting when the temporary spare area is overwritten by user data. Accordingly, when the temporary spare area is overwritten by the user data, the background formatting is resumed. Thus the incorrect spare data may be prevented from being recorded in the temporary spare area of the information recording medium due to cutoff of the electrical source of the drive device before the temporary spare area is updated.

[0151]

The invention according to claim 13 refers to the information recording apparatus according to claim 11, wherein the second resuming means resumes the background formatting when a recording area requested by the user is reallocated to the spare area and the data in the spare area is updated by recording performed in the spare area. Accordingly, when the spare area is updated by the recording performed in the spare area, the background formatting is resumed. Thus the incorrect spare data may be prevented from being recorded in the temporary spare area of the information recording medium due to cutoff of the electrical source of the drive device before the temporary spare area is updated.

[0152]

The invention according to claim 14 refers to the information recording apparatus according to claim 11, wherein the second resuming means resumes the background formatting when a defect area is newly detected in the user data area and the data in the spare area is reallocated to another spare area. Accordingly, when a defect area is newly detected in the user data area and the data in the spare area is reallocated to another spare area, the background formatting is resumed. Thus the incorrect spare data may be prevented from being recorded in the temporary spare area of the information recording medium due to cutoff of the electrical source of the drive device before the temporary spare area is updated.

[0153]

The invention according to claim 15 refers to the information recording apparatus according to claim 10, wherein the information recording medium is an information recording medium according to the DVD + MRW standard, the spare area is a Spare Area 2, the temporary spare area is a Temporary Spare Area 2, and the first resuming means resumes the background formatting when the data in the Temporary Spare Area 2 is changed. Accordingly, effect according to the invention described in claim 10 may be achieved in the information recording medium according to the DVD + MRW standard.

[0154]

The invention according to claim 16 refers to the information recording apparatus according to claim 11, wherein the information recording medium is an information recording medium according to the DVD + MRW standard, the spare area is a Spare Area 2, the temporary spare area is a Temporary Spare Area 2, and the second resuming means resumes the background formatting when the data in the Spare Area 2 is changed. Accordingly, effect according to the invention described in claim 11 may be achieved in the information recording medium according to the DVD + MRW standard.

[0155]

The invention according to claim 17 refers to an information recording method, using hardware resources, for executing an information recording step of recording data on an information recording medium including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area, a data reallocating step of reallocating the data to the spare area, a temporary spare area recording step of generating a temporary spare area by temporarily copying the data in the spare area to the user data area, and a fist updating step of updating the temporary spare area by copying the data in the spare area to another user data area when the data in the temporary spare area is changed. Accordingly, when the data in the temporary spare area is changed, data in the spare area is copied to another user data area. Thus, the temporary spare area may be updated and correct spare data may be always recorded in the temporary spare area.

[0156]

The invention according to claim 18 refers to an information recording method, using hardware resources, for executing an information recording step of recording data on an information recording medium including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area, a data reallocating step of reallocating the data to the spare area, a temporary spare area recording step of generating a temporary spare area by temporarily copying the data in the spare area to the user data area, and a second updating step of updating the temporary spare area by copying the data in the spare area to another user data area when the data in the spare area is changed. Accordingly, when the spare area is updated, data in the spare area is copied to another user data area. Thus, the temporary spare area may be updated and correct spare data may be always recorded in the temporary spare area.

[0157]

The invention according to claim 19 refers to an information recording method, using hardware resources, for executing an information recording step of recording data on an information recording medium including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area, a background formatting step of formatting the information recording medium in a background, a background formatting resuming step of resuming background formatting when the information recording medium is partially formatted, a data reallocating step of reallocating the data to the spare area, a temporary spare area recording step of generating a temporary spare area by temporarily copying the data in the spare area to the user data area, and a first resuming step of resuming the background formatting when the data in the temporary spare area is changed. As described above, the background formatting is resumed when it is necessary to update the temporary spare area. Thus the incorrect spare data may be prevented from being recorded in the temporary spare area of the information recording medium due to cutoff of the electrical source of the drive device before the temporary spare area is updated.

[0158]

The invention according to claim 20 refers to an information recording method, using hardware resources, for executing an information recording step of recording data on an information recording medium including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area, a background formatting step of formatting the information recording medium in a background, a background formatting resuming step of resuming background formatting when the information recording medium is partially formatted, a data reallocating step of reallocating the data to the spare area, a temporary spare area recording step of generating a temporary spare area by temporarily copying the data in the spare area to the user data area, and a second resuming step of resuming the background formatting when the data in the spare area is changed. As described above, the background formatting is resumed when it is necessary to update the spare area. Thus the incorrect spare data may be prevented from being recorded in the temporary spare area of the information recording medium due to cutoff of the electrical source of the drive device before the temporary spare area is updated.

[0159]

The invention according to claim 21 refers to a machine-readable program for recording information installed in a computer, for causing the computer to execute an information recording step of recording data on an information recording medium including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area, a data reallocating step of reallocating the data to the spare area, a temporary spare area recording step of generating a temporary spare area by temporarily copying the data in the spare area to the user data area, and a first updating step of updating the temporary spare area by copying the data in the spare area to another user data area when the data in the temporary spare area is changed. Accordingly, when the data in the temporary spare area is changed, data in the spare area is copied to another user data area. Thus, the temporary spare area may be updated and correct spare data may be always recorded in the temporary spare area.

[0160]

The invention according to claim 22 refers to a machine-readable program for recording information installed in a computer, for causing the computer to execute an information recording step of recording data on an information recording medium including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area, a data reallocating step of reallocating the data to the spare area, a temporary spare area recording step of generating a temporary spare area by temporarily copying the data in the spare area to the user data area, and a second updating step of updating the temporary spare area by copying the data in the spare area to another user data area when the data in the spare area is changed. Accordingly, when the spare area is updated, data in the spare area is copied to another user data area. Thus, the temporary spare area may be updated and correct spare data may be always recorded in the temporary spare area.

[0161]

The invention according to claim 23 refers to a machine-readable program for recording information installed in a computer, for causing the computer to execute an information recording step of recording data on an information recording medium including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area, a background formatting step of formatting the information recording medium in a background, a background formatting resuming step of resuming background formatting when the information recording medium is partially formatted, a data reallocating step of reallocating the data to the spare area, a temporary spare area recording step of generating a temporary spare area by temporarily copying the data in the spare area to the user data area, and a first resuming step of resuming the background formatting when the data in the temporary spare area is changed. As described above, the background formatting is resumed when it is necessary to update the temporary spare area. Thus the incorrect spare data may be prevented from being recorded in the temporary spare area of the information recording medium due to cutoff of the electrical source of the drive device before the temporary spare area is updated.

[0162]

The invention according to claim 24 refers to a machine-readable program for recording information installed in a computer, for causing the computer to execute an information recording step of recording data on an information recording medium including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area, a background formatting step of formatting the information recording medium in a background, a background formatting resuming step of resuming background formatting when the information recording medium is partially formatted, a data reallocating step of reallocating the data to the spare area, a temporary spare area recording step of generating a temporary spare area by temporarily copying the data in the spare area to the user data area, and a second resuming step of resuming the background formatting when the data in the spare area is changed. As described above, the background formatting is resumed when it is necessary to update the temporary spare area. Thus the incorrect spare data may be prevented from being recorded in the temporary spare area of the information recording medium due to cutoff of the electrical source of the drive device before the temporary spare area is updated.

[0163]

The invention according to claim 25 refers to a storage medium for storing the program for recording information according to claims 21 through 24. Accordingly, same operational effect as the operational effect achieved in the program for recording information according to any one of claims 21 through 24 may be achieved.

[0164]

The invention according to claim 26 refers to an information recording system, including an information recording apparatus for recording data on an information recording medium and including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area, and a host apparatus which instructs the information recording apparatus to perform an information recording operation, wherein either one of or both of the information recording apparatus and the host apparatus include as a whole an information recording means for recording data on the information recording medium, a data reallocating means for reallocating the data to the spare area, a temporary spare area recording means for generating a temporary spare area by temporarily copying the data in the spare area to the user data area, and a first updating means for updating the temporary spare area by copying the data in the spare area to another user data area when the data in the temporary spare area is changed. Accordingly, when the data in the temporary spare area is changed, data in the spare area is copied to another user data area. Thus, the temporary spare area may be updated and correct spare data may be always recorded in the temporary spare area.

[0165]

The invention according to claim 27 refers to an information recording system, including an information recording apparatus for recording data on an information recording medium and including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area, and a host apparatus for instructing the information recording apparatus to perform an information recording operation, wherein any one of or both of the information recording apparatus and the host apparatus include as a whole an information recording means for recording data on the information recording medium, a data reallocating means for reallocating the data to the spare area, a temporary spare area recording means for generating a temporary spare area by temporarily copying the data in the spare area to the user area, and a second updating means for updating the temporary spare area by copying the data in the spare area to another user data area when the data in the spare area is changed. Accordingly, when the spare area is updated, data in the spare area is copied to another user data area. Thus, the temporary spare area may be updated and correct spare data may be always recorded in the temporary spare area.

[0166]

The invention according to claim 28 refers to an information recording system including an information recording apparatus for recording data on an information recording medium and including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area, and a host apparatus for instructing the information recording apparatus to perform an information recording operation, wherein any one of or both of the information recording apparatus and the host apparatus include as a whole an information recording means for recording data on the information recording medium, a background formatting means for formatting the information recording medium in a background, a background formatting resuming means for resuming background formatting when the information recording medium is partially formatted, a data reallocating means for reallocating the data to the spare area, a temporary spare area recording means for generating a temporary spare area by temporarily copying the data in the spare area to the user data area, and a first resuming means for resuming the background formatting when the data in the temporary spare area is changed. As described above, the background formatting is resumed when it is necessary to update the temporary spare area. Thus the incorrect spare data may be prevented from being recorded in the temporary spare area of the information recording medium due to cutoff of the electrical source of the drive device before the temporary spare area is updated.

[0167]

The invention according to claim 29 refers to an information recording system, including an information recording apparatus for recording data on an information recording medium and including a user data area for recording data requested by a user and a spare area for reallocating a defect existing in the user data area, and a host apparatus for instructing the information recording apparatus to perform an information recording operation, wherein any one of or both of the information recording apparatus and the host apparatus include as a whole an information recording means for recording data on the information recording medium, a background formatting means for formatting the information recording medium in a background, a background formatting resuming means for resuming background formatting when the information recording medium is partially formatted, a data reallocating means for reallocating the data to the spare area, a temporary spare area recording means for generating a temporary spare area by copying the data in the spare area to the user data area, and a second resuming means for resuming the background formatting when the data in the spare area is changed. As described above, the background formatting is resumed when it is necessary to update the spare area. Thus the incorrect spare data may be prevented from being recorded in the temporary spare area of the information recording medium due to cutoff of the electrical source of the drive device before the temporary spare area is updated.

[Brief Description of the Drawings]

[Fig. 1] Fig. 1 is a frame format illustrating an example of a configuration of an optical disk device.

[Fig. 2] Fig. 2 is a frame format illustrating an example of a configuration of an information recording system.

[Fig. 3] Fig. 3 is a frame format illustrating a recording format of an optical disk (DVD + MRW).

[Fig. 4] Fig. 4 is a flowchart illustrating a flow of updating processing of a temporary spare area (TSA2).

[Fig. 5] Fig. 5 is a flowchart illustrating a flow of resuming processing of background formatting.

[Fig. 6] Fig. 6 is a flowchart illustrating a flow of reproduction processing.

[Fig. 7] Fig. 7 is a frame format illustrating the recording format of the optical disk (CD - MRW and DVD + MRW)

[Fig. 8] Fig. 8 is a frame format illustrating the recording format of the optical disk (CD - MRW and DVD + MRW).

[Fig. 9] Fig. 9 is a frame format illustrating the recording format of the optical disk (CD - MRW and DVD + MRW).

[Reference Numerals]

101	Information recording apparatus
115	Host apparatus
DA	User data area
SA	Spare area
SA1	Spare area
SA2	Spare area, Spare Area 2
TSA	Temporary spare area
TSA2	Temporary spare area, Temporary Spare Area 2
LWA	Last written address
TLO	Temporary lead-out

[Selected Drawing] Fig. 3

[Name of Document] Abstract of the Disclosure

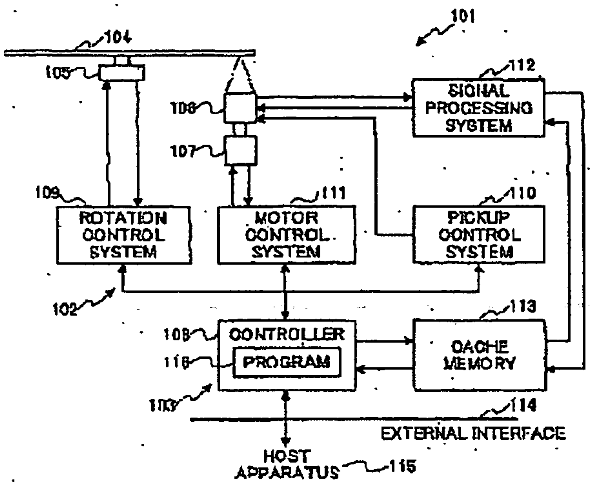
[Abstract]

[Object of the Invention] To cause a temporary spare area (TSA2, for instance) to correctly reflect data of a spare area (SA2, for instance) even when the temporary spare area or the spare area of a partially formatted DVD + MRW disk or a similar recording medium is overwritten.

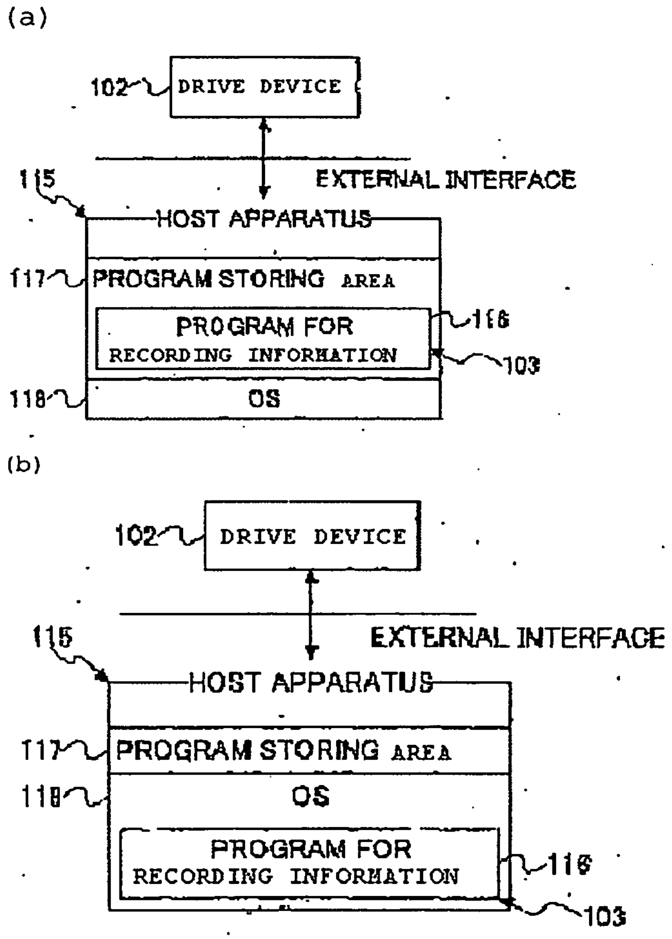
[Means for Solving Problems] When data in a temporary spare area or a spare area is changed, the data in the spare area is copied to another user data area. Thus the temporary spare area is updated and correct spare data is always recorded in the temporary spare area. Accordingly, the temporary spare area correctly reflects the data in the spare area.

[Name of Document]

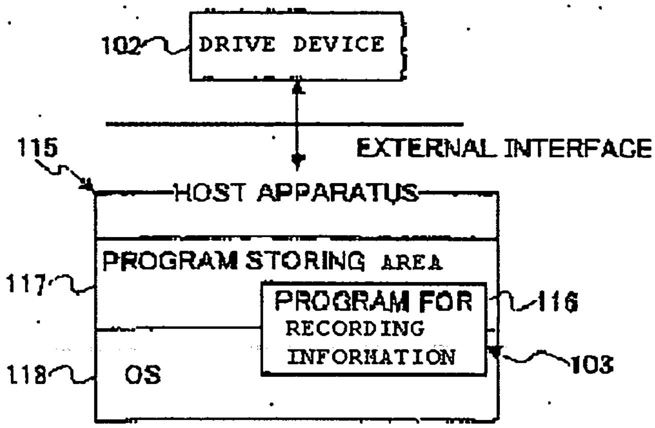
[Fig. 1]



[Fig. 2]

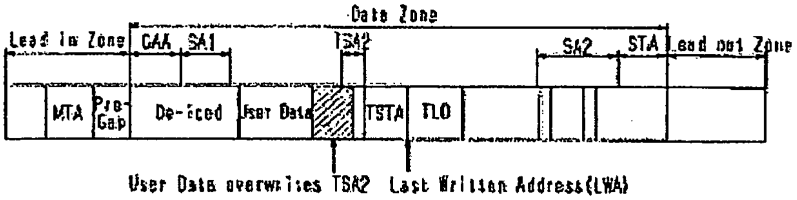


(C)

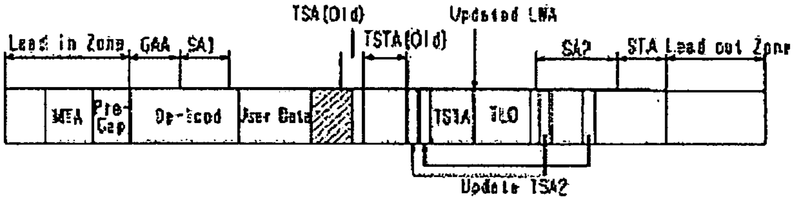


[Fig. 3]

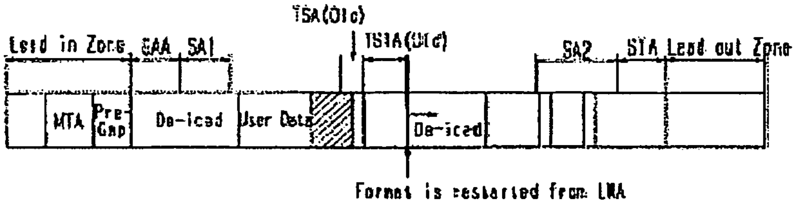
(a) User Data overwrite TSA2 area



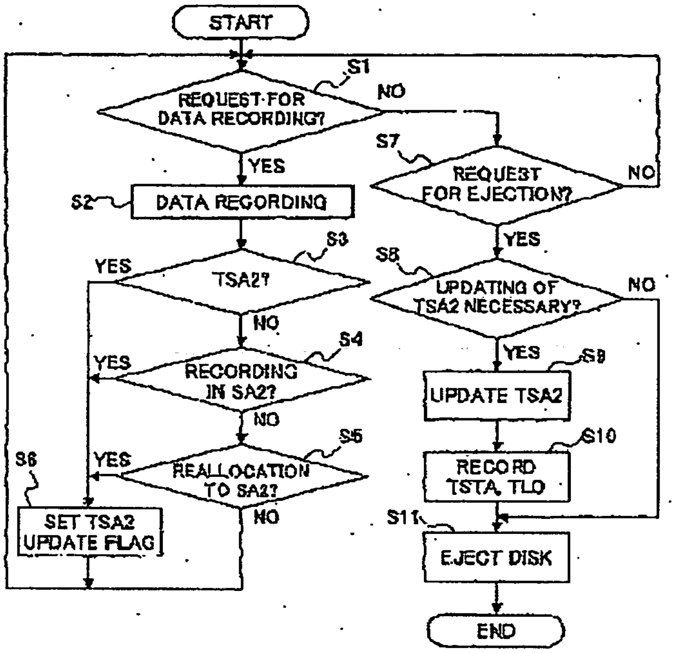
(b) Update TSA2



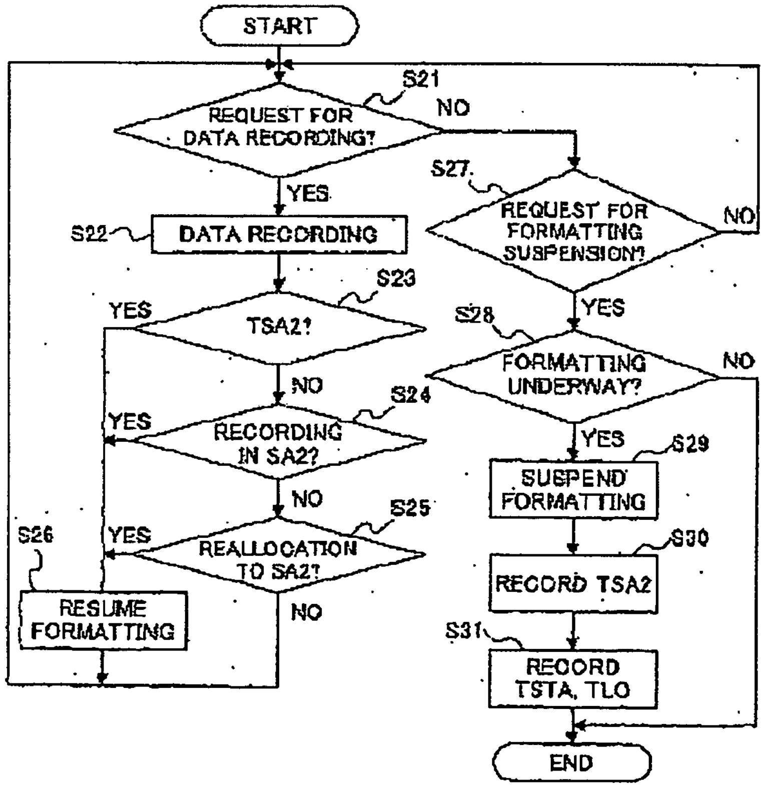
(c) Format is restarted



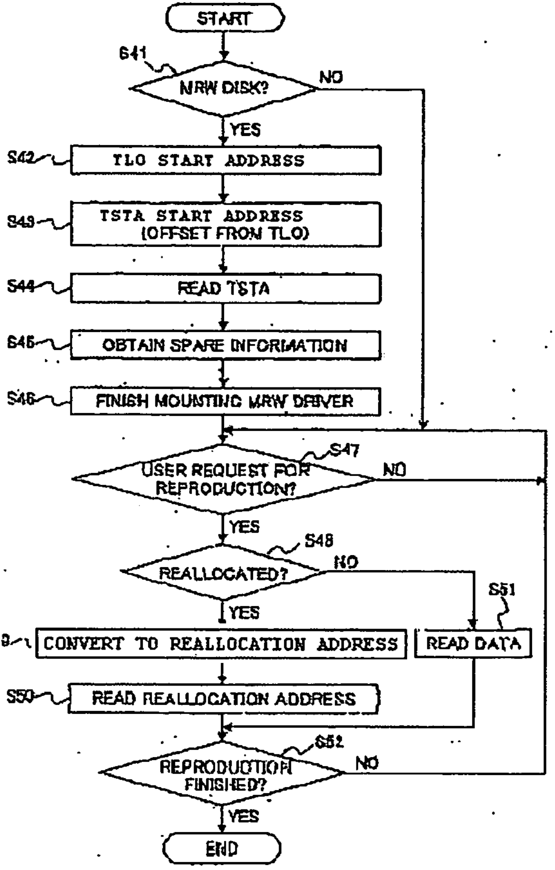
[Fig. 4]


START
S1
REQUEST FOR DATA RECORDING?
NO
YES
S2
DATA RECORDING
S3
TSA2?
YES
NO
S4
RECORDING IN SA2?
YES
NO
S5
REALLOCATION TO SA2?
YES
NO
S6
SET TSA2 UPDATE FLAG
S7
REQUEST FOR EJECTION?
NO
YES
S8
UPDATING OF TSA2 NECESSARY?
NO
YES
S9
UPDATE TSA2
S10
RECORD TSTA, TLO
S11
EJECT DISK
END

[Fig. 5]

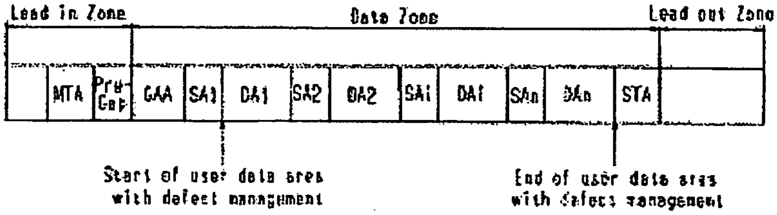

START
S21
REQUEST FOR DATA RECORDING?
NO
YES
S22
DATA RECORDING
S23
TSA2?
YES
NO
S24
RECORDING IN SA2?
YES
NO
S25
REALLOCATION TO SA2?
YES
NO
S26
RESUME FORMATTING
S27
REQUEST FOR FORMATTING SUSPENSION?
NO
YES
S28
FORMATTING UNDERWAY?
NO
YES
S29
SUSPEND FORMATTING
S30
RECORD TSA2
S31
RECORD TSTA, TLO
END

[Fig. 6]

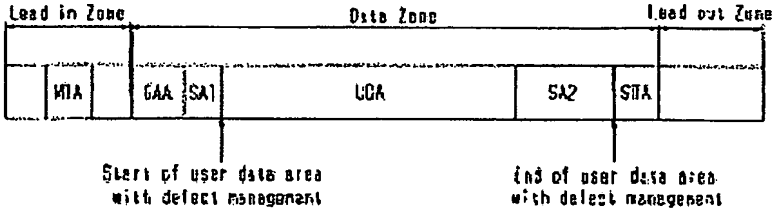


[Fig.7]

(a) CD-MRW

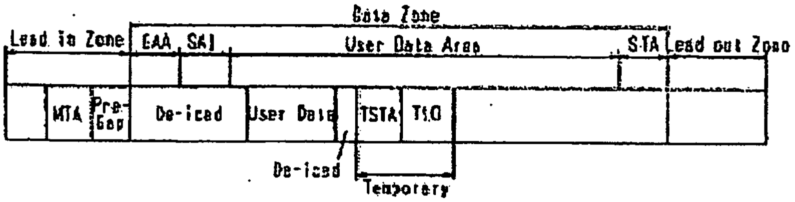

Lead in Zone
Data Zone
Lead out Zone
MTA
Pre-Gap
GAA
SA1
DA1
SA2
DA2
SAi
DAi
SAn
DAn
STA
Start of user data area with defect management
End of user data area with defect management

(b) DVD+MRW

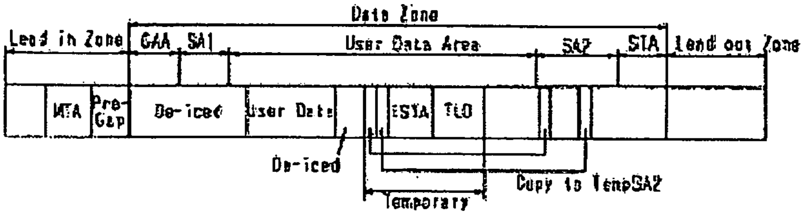

Lead in Zone
Data Zone
Lead out Zone
MTA
GAA
SA1
UDA
SA2
STA
Start of user data area with defect management
End of user data area with defect management

[Fig. 8]

(a) CD-MRW

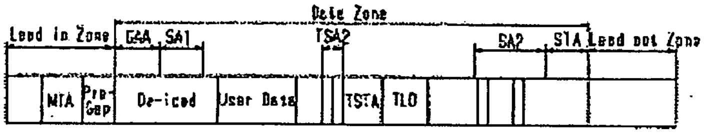


(b) DVD+MRW

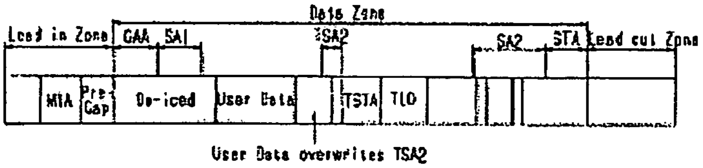


[Fig. 9]

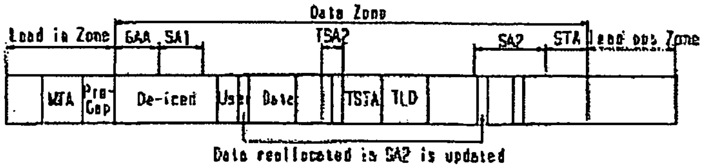
(a) Partially formatted DVD+MRW



(b) User Data overwrite TSA2 area



(C) Data reallocated in SA2 is updated



(D) New defect area is reallocated in SA2